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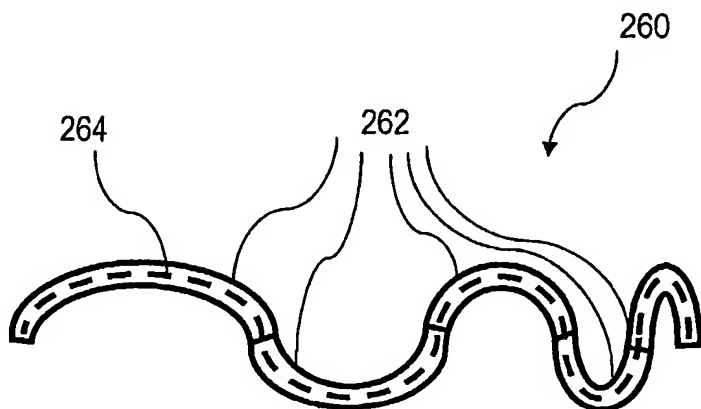
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: TEMPERATURE RESPONSIVE SYSTEMS



(57) Abstract: A shape memory material activated device of the present invention uses a shape memory material activator to create a path through a shell wall of the device. The path through the shell wall may release a substance contained in the shell or allow a substance to enter the shell. The path may be created by fracturing, puncturing, exploding, imploding, peeling, tearing, stretching, separating, debonding, abrading or otherwise opening the shell and, may be permanent or reversible. The substance may be released in one location while the device is stationary or along a path while it is traveling, self-powered by the shape memory material activator. In addition, the substance may be delivered to an object upon contact with its surface. The self powering abilities allow these devices to be used as substance delivery devices as well as actuators, transporters, and

energy conversion systems with modular characteristics and growth potential. The devices may be armed, prior to the beginning of their service life, to be placed in a state of readiness to release their substances once the path is created. Prior to arming they may be maintained at any temperature, incapable of releasing their substances. The devices according to the present invention may be used as temperature sensors or warning devices, drug delivery devices, and the like.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/08338

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A61K 9/22

US CL : 604/890.1

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 604/890.1, 891.1, 892.1, 20, 21, 304, 93.01, 288.01, 288.02, 288.03, 288.04, 131, 132, 134, 135; 128/dig. 12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6436078 B1 (SVEDMAN et al.) 20 August 2002 (20.08.2002), figures 73 and 75 and element 146 and the associated text	169
Y	US 6,425,343 B1 (AKERS et al.) 30 July 2002 (30.07.2002), figures 11A-11C and the associated text	5-7, 38-40
X	US 5,843,700 (KERROD et al.) 01 December 1998 (01.12.1998), entire document	1-5, 10, 11, 15, 34-38, 43, 44, 154-158, 161, 162, 164, 168, 170, 173, 174, 176, 77
X	US 5,405,614 A (D'ANGELO et al.) 11 April 1995 (11.04.1995), entire document	154-157, 159, 161, 165-168, 170, 173, 174, 176, 178 and 179
A	US 5,196,002 A (HANOVER et al.) 23 March 1993 (23.03.1993)	137-146, 148, 151-153
X	US 5,167,626 A (CASPER et al.) 1 December 1992 (01.12.1992), entire document	1-3, 5, 9, 11, 12, 14
Y		154-165, 167-170, 173, 174, 176, 178, 179

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,627,850 (DETERS et al.) 9 December 1986 (09.12.1986), entire document	154-160, 163, 167-170
A	US 4,439,197 A (HONDA et al.) 27 March 1984 (27.03.1984), entire document	1-15, 34-44
Y	US 3,659,600 A (MERRILL) 3 May 1972 (03.05.1972), elements 5 and 6 and associated text	154-170, 173, 174, 176-179
A	JP 58-194809 (YAMADA) 12 November 1983 (12.11.1983), entire document, see English abstract	1-15, 34-44, 154-170, 173, 174, 176-179
Y	JP 58-135808 (SEKIGUCHI) 12 August 1983 (12.10.1983), entire document, see English abstract	154-164, 166-168, 170, 173, 174, 176, 177

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-15, 34-44, 137-146, 148, 151-170, 173, 174 and 176-179

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

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BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-15, 34-44, 137-146, 148, 151-170, 173, 174 and 176-179 drawn to a device or method for opening a shell containing a substance wherein the shape memory activator responds to temperature.

Group II, claim(s) 16-33 and 147, drawn to a temperature activated actuator.

Group III, claims 149 and 171, drawn to a device for opening a shell by an activator responsive to temperature wherein the device is an implant.

Group IV, claims 150 and 172, drawn to a device for opening a shell by an activator responsive to temperature wherein the device is a warning device.

Group V, claims 45-115 and 175 drawn to a self propelled device and a self-driven system.

Group VI, claims 116-136, drawn to an energy conversion system having a plurality of energy transmission means.

Group VII, claims 180-201 and 204-207, drawn to a device configured to create a path through a shell by pressure altering means.

Group VIII, claim 202, drawn to a device that creates a path through a shell by pressure altering means wherein the device is an implant.

Group IX, claim 203, drawn to a device that creates a path through a shell by pressure altering means wherein the device is a temperature warning device.

Group X, claims 208-216 and 219-223, drawn to a device wherein the device stimulates one or more senses.

Group XI, claim 217, drawn to a device wherein the device is a temperature alarm system that stimulates the senses.

Group XII, claim 218, drawn to a device wherein the device is a toy that stimulates the senses.

Group XIII, claims 224-235, drawn to a delivery system comprising a plurality of temperature based devices to release a plurality of substances to produce a combined effect.

Furthermore, Group V contains claims directed to more than one species of the generic invention. The following species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

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The following claim(s) are generic: 45-47, 51-58, 90-104 and 175.

The following claims:

Species A, claim 48;
Species B, claim 49;
Species C, claim 50;
Species D, claims 59, 64-74, 81-89, 105 and 112-115;
Species E, claims 60, 75 and 106;
Species F, claims 61, 76, 77, 107 and 108;
Species G, claims 62, 78 and 109; and
Species H, claims 63, 79 and 110 are not generic since the SMA devices claimed in the above species are not the same device. Therefore there is no same or corresponding special technical feature.

The inventions listed as Groups I through XIII do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Group I is device or method for opening a shell containing a substance wherein the shape memory activator responds to temperature.
Group II is a temperature activated actuator.
Group III is an implant for opening a shell by an activator responsive to temperature.
Group IV is a warning device for opening a shell by an activator responsive to temperature.
Group V is a self propelled device and a self-driven system.
Group VI is an energy conversion system having a plurality of energy transmission means.
Group VII is a device configured to create a path through a shell by pressure altering means.
Group VIII is an implant that creates a path through a shell by pressure altering means.
Group IX is a temperature warning device that creates a path through a shell by pressure altering means.
Group X is a device having a shell with a substance wherein the device stimulates one or more senses.
Group XI is a temperature alarm system with a substance that stimulates the senses.
Group XII is a toy with a substance that stimulates the senses.
Group XIII is a delivery system comprising a plurality of temperature based devices to release a plurality of substances to produce a combined effect.

The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons:

Species A-H are self propelled devices wherein the SMA devices claimed in the above species are not the same device. Therefore there is no same or corresponding special technical feature.